GERMAN POLYTECHNIC CONGRESS.—At the recent inauguration of the new Polytechnic Institution of Brunswick, the assembled men of science considered the question of a general congress of lecturers at the German polytechnic schools. It is intended to hold the congress at Dresden, and a preliminary meeting of delegates will take place in the beginning of April, in order to fix the programme for the congress. Dresden has also been selected as the meeting-place for a congress of German engineers and architects, and it is supposed that the two meetings will be held simultaneously.

SAXONY.—An interesting example of the comparative sums devoted in Germany to various educational purposes is to be seen in the recently-issued Report of the Minister of Public Instruction for Saxony, a kingdom with 2,550,000 inhabitants. The whole number of educational establishments is 3,900, of scholars and students, 523,000, of instructors, 6,400. The salaries amount to 12,300,000 marks, and the total educational expenses are 18,000,000, of which 5,000,000 are contributed by the Government. The State devotes 766,000 marks to its 76 gymnasia and *Realschulen*, 1,354,000 to the general school system, and nearly as much, viz., 1,048,000 marks to the University of Leipzig with its 161 professors and 3,100 students, besides 893,000 marks for pensions. The total annual cost of the Leipzig University is 1,402,000 marks, or 70,100*l*.

SCIENTIFIC SERIALS

Annalen der Physik und Chemie, No. 1, 1878.—The universal compensator, by M. Beetz.—On the electromotive force and the internal resistance of some thermopiles, by M. Beetz.—The theory of stationary currents regarded from a quite general standpoint, by M. v. Bezold.—On a tangent multiplier and the electromotive force of the Grove element, by M. Riecke.—On the influence of density of a body on the amount of light absorbed by it, by M. Glan.—On the theory of the longitudinal-elliptical vibrations in the incompressible ether, by M. Ketteler.—On fluorescence, by M. Lommel.—On metallic reflection, by M. Wernicke.—On the volume-increase of liquids through absorption of gases, by Messrs. MacKenzie and Nichols.—Some observations on Crookes's radiometer, by M. Riecke.—Determination of the resonance-tones of the mouth-cavity by percussion, by M. Auerbach.—On the pitch of a tuning-fork in an incompressible liquid, by M. Auerbach.

Zeitschrift für wissenschaftliche Zoologie, vol. xxx., part 1.—Rhizopod studies, by Emil Buck, 49 pp. 2 plates; dealing with the development of arcella, and a new genus parasitic on rotifers.—Revision of the genus analges (avian parasite), by G. Haller.—Contribution to the anatomy of asteridæ, by Hubert Ludwig, 4 plates, 63 pp., describing the water-vascular system, the blood system, the nervous and the generative apparatus, the body cavity.—Contribution to the natural history of the cestodes, by H. A. Pagenstecher, dealing with *Tænia crilica* and *Cœnurus serialis*.

SOCIETIES AND ACADEMIES

LONDON

Linnean Society, February 21.—W. Carruthers, F.R.S., vice-president, in the chair.—Mr. Thos. Christy illustrated by diagram and made remarks on M. Ossenkep's new system of plant-propagation; and he also showed the recently imported fresh berries of the Liberian coffee of this year's crop.—Mr. Holmes exhibited a remarkable oak gall of *Aphilothrix sieboldii*, Hart., obtained at Willesboro, Leas, Ashford.—Mr. Thiselton Dyer likewise exhibited and made a few observations on the inflorescence and a drawing of the palm *Ptychosperma rupicola*, Thw., which had flowered for the first time in Europe at Kew.—A paper, notes on the Mahwa tree (*Bassia latifolia*), was read by Mr. E. Lockwood. This tree grows in abundance in India; a hundred thousand may be seen in the plains around Monghyr. Wild animals of all kinds greedily devour the flowers, of which one tree will yield several hundredweights. Besides being highly nutritious to man, it is an excellent fattening agent for cattle, &c. A strong-smelling spirit is obtained by distillation of the corolla, an essential oil from the fruit, and as an agent in soap-making the tree is invaluable. Thus, certain yield, unlimited supply, nourishing and chemical qualities, easy preservation, and its cheapness, all combine to render it a commercial product of no mean importance to our Indian empire.—The gist of a "Synopsis of the Hypoxidaceæ," by Mr. J. G. Baker, was given. This group differs in some respects from the Amaryllidaceæ, and offers a close alliance with the Bellosiceæ. Four genera, and between sixty and seventy species are known. The Cape is their head-quarters, but some are found in Tropical Africa and Angola, a very few in Abyssinia and the Mascarenes. None are found in Europe, Polynesia, North and Central Asia, nor Extra Tropical South America.—The Secretary read an abstract of a technical paper on the Schoepfieæ and Cervantesiæ, distinct tribes of the Styraceæ, by John Miers, F.R.S.—Then followed a communication by Mr. Arthur G. Butler, on the butterflies in the collection of the British Museum, hitherto referred to the genus Euploea of Fabricius.—Dr. Hance, of China, Mr. E. Milner, Dr. Geo. Shearer, and the Rev. R. Boog Watson were elected Fellows of the Society.

Chemical Society, February 21.—Dr. Gladstone, president, in the chair.—A lecture entitled "Laboratory Experiences on board the *Challenger*" was delivered by Mr. J. Y. Buchanan. After describing his laboratory, which measured 10 feet by 5 feet 8 inches and 6 feet high, and its fittings, the lecturer gave a detailed account of the means by which, after estimating the compressibilities of water and mercury, he was enabled to determine the depths and temperatures attained by the sounding line. The compressibility of distilled water was found to be 0·000049 per atmosphere, or 0·0009 per 100 fathoms; of sea-water, 0·00077 per 100 fathoms; and of mercury, 0·0000271 per 100 fathoms, or 0·0000015 per atmosphere. He then described the apparatus and methods by means of which the amounts of oxygen, nitrogen, and carbonic acid were determined. The most interesting results obtained were the following:—From the surface down to 300 fathoms the amount of oxygen continuously decreases; from 300 fathoms downwards, whatever be the depth, the amount increases. This anomalous result the lecturer stated to be due to the great abundance of animal life at the depth of 300 fathoms, the increase in the quantity of oxygen at greater depths being caused by its non-consumption, owing to the scarcity of life. The next part of the lecture dealt with the distribution of the sea-water as regards density, in depth and superficially. Two regions of maximum density exist north and south of the equator, corresponding to the tracts frequented by the trade winds. At 350 fathoms deep a great zone of water of low density is found. The densest water is found in the Atlantic. Light water is found in the neighbourhood of ice and in certain regions immediately after the cessation of the monsoons. The maxima of density lie in the north hemisphere to the south-west, in the south to the north-west of the maxima of barometric pressure. A hearty and unanimous vote of thanks was given to Mr. Buchanan for his interesting lecture, which was illustrated by many tables and diagrams.

Physical Society, February 16.—Prof. W. G. Adams, president, in the chair.—The following candidate was elected a Member of the Society: Mr. G. H. West, M.A.—Dr. Lodge read, for Mr. H. F. Morley, M.A., a paper on Grove's gas battery. After referring to the views of M. Gaugain and Mr. Grove himself with regard to the cause of the action of this apparatus, the author proceeded to describe an elaborate series of experiments he has recently made in order to ascertain the circumstances by which it is regulated. It would be impossible to give a clear account of them in a short space, but some of his conclusions are as follows:—The whole of the current is due to dissolved gas, and if n be the distance of the level of the liquid from the top of the plate in the H tube, and $E = \frac{C\,R}{1{,}000}$, C being given in galvanometric readings and R in ohms, he finds that, approximately, $(1 + n\,a)\,C = b + n\,e - (c + n\,d)\,E$, where a, b, c, d, and e are constants. The electromotive force is not constant, but rises with the resistance. The current is greater in proportion as the gas present in the elements is less; and, finally, the current appears to vary directly with the pressure.—Mr. S. C. Tisley then described the harmonograph, specially referring to its use for drawing pairs of curves for the stereoscope. This, the latest forms of his pendulum apparatus, is capable of giving a very great variety of curves, for, in addition to rectangular vibrations, parallel and elliptic motions can be combined by its means. In the older form of apparatus each pendulum moves on the other as a centre, whereas in the instrument described they are independent. One pendulum carries at its upper end a table which can be caused to rotate by clockwork if required. The whole is supported on a kind of gimbal joint formed of two pairs of knife edges at right angles, so arranged that vibration

can take place either on one or the other, or the two can be so combined as to give a circular motion; or again, the pendulum can be caused to vibrate in any given plane. The second pendulum vibrates in the plane in which the two hang, and carries at its upper end an arm terminating in a pencil over the table of the other pendulum. A very ingenious adjustment renders it possible to raise or lower the bob of the second-named pendulum during its motion. If two pens be attached, about 2½ inches apart, instead of the single one usually employed, and two curves be traced, they are not precisely similar, and when viewed in a stereoscope they are found to give the well-known appearance of solidity to the figure. It was further shown that by gradually changing the relative motions of the pendulums it is possible to impart to the curve many of the forms observed in biaxial crystals in the polariscope.—Mr. F. J. M. Page then exhibited the action of the telephone on a capillary electrometer. The construction of Lippman's electrometer as modified by Marey was first explained, and the meniscus of the mercury in the capillary tube was thrown on the screen by the electric light. The delicacy of the instrument was shown by passing a current of $\frac{1}{1000}$th of a Daniell, which caused a distinct movement of the mercury. Resistance of 5,000 ohms and $\frac{1}{10}$th ohm gave approximately the same deflection; so that, in practice, the instrument may be considered to be independent of resistance, in addition to which it possesses the great advantage of portability, and its indications are almost instantaneous. To illustrate the use of the electrometer for physiological investigations, a frog's heart was connected by non-polarisable electrodes with the instrument; each beat of the heart caused a considerable movement of the mercury column. A telephone was now connected; on pressing in the iron plate the mercury moved, and on reversing the wires the movement was seen to be in the opposite direction. On singing to the telephone each note produced a movement, but the fundamental note of the plate as well as its octaves and fifths had the greatest effect. On speaking the mercury oscillated continually; some letters of the alphabet had scarcely any effect, and the *w* was especially curious, producing a double movement. Reversing the wires did not alter the character or *direction* of these movements. The same effect was observed when the telephone was in the primary and the electrometer in the secondary coil of a Du Bois Reymond's induction coil. In conclusion, Mr. Page showed the contractions produced in a frog's leg; on inserting under the sciatic nerve two platinum wires coupled with the binding screws of a telephone and talking to this instrument, violent contractions ensued. In the course of the discussion which followed, Prof. Graham Bell expressed himself as highly gratified at the results of Mr. Page's experiments. He has made very many attempts to ascertain the strength of the current produced by the human voice in vain, but considers the present method will in all probability give some most valuable results. He was quite unable to account for the fact that the motion of the mercury took place *from* the opening, but this seems to depend on conditions not yet determined.—Mr. Wilson then exhibited, for Prof. S. P. Thompson, a lantern slide galvanometer for showing the deflections of the needle to an audience. It consists of a coil of insulated copper wire wound on a flat bobbin, within which a needle is balanced on a horizontal axis; this needle carries a long needle of aluminium traversing a semicircular divided photographic scale, and as this is transparent the index can be projected on to the screen. The whole is inclosed between two glass plates.

Geological Society, February 20.—Henry Clifton Sorby, F.R.S., president, in the chair.—James W. Carrall, Tientsin, China, Edward Cleminshaw, Percy John Neate, Arthur Nicols, John Snell, and John Spencer were elected Fellows of the Society.—The following communications were read:—Notes on the physical geology of the Upper Punjàb, by A. B. Wynne, F.G.S. The author stated that crystalline rocks are rare in the accession parts of the Upper Punjàb district, and that when present they consist of syenite and gneiss. The Cambrian and Silurian formations are represented by more or less metamorphosed azoic slates in the Himalayan district, and in the Salt Range by a zone less than 200 feet thick, containing either *Obolus* or *Siphonotreta*, underlain by a thick unfossiliferous sandstone, beneath which is a deposit of gypseous marl and salt. Above the Silurian in the Salt Range, and conformable to it, comes the magnesian sandstone group and a group of unfossiliferous sandstones and clays; in the Himalaya these deposits are probably represented by an unfossiliferous siliceous dolomite, which rests unconformably upon the slates. There are no fossils indicative of rocks of Devonian age. The carboniferous rocks, are also conformably deposited on limestones, sandstones, and shales, the last sometimes carbonaceous. These deposits contain hæmatite in sockets, and the oldest known ammonites have been found in them. An infra-triassic group occurring in Lei Bau mountain consists of red shales, sandstones, and red quartzitic dolomites, overlain by lighter-coloured siliceous dolomites, which in their turn are covered by hæmatite, quartz breccia, sandstones, and shales. The author believes these to have been deposited by the same waters which subsequently laid down the trias, which is largely composed of limestones in the northern Himalayan area, and here and elsewhere includes dolomites, shales, and sandstanes. Numerous fossils occur in some of the beds, such as *Dicerocardium*, *Megalodon*, and *Nerinæa*. In the western part of the Salt Range conglomerates composed of great blocks are regarded by the author as evidence of proximity of land. The Jurassic deposits are local in their distribution, and consist of shales, sandstones, and limestones, containing abundant fossils, such as belemnites, ammonites, and saurians. A dark limestone contains also *Gryphæa* and *Trigoniæ*. The cretaceous deposits, when present, are conformable to the carboniferous; they are variable in thickness and fossil contents, and are not recognisable near Attock between the Jurassic and nummulitic groups. Further east a group, supposed to be cretaceous, includes clays with boulders of crystalline rock, which the author regards as derived from land to the south. One of these boulders presented glacial striæ. The eocene rocks are generally limestones, and lie conformably upon the subjacent formations. The nummulitic series of the Salt Range includes gypseous and coaly shales. The salt beds sometimes attain a thickness of over 1,000 feet. The Miocene and Pliocene deposits are of immense thickness, and contain only fossils of terrestrial and fresh-water origin, so that the deposits were formed in lakes and inland seas. The tertiary epoch closed with the elevation of the Himalayas and Salt Range, which was followed by a long period of change, during which various deposits were produced, some including great quantities of erratics, which, however, the author believes were brought to their present position rather by floating ice than by the extension of glaciers.—Description and correlation of the Bournemouth beds; Part I., Upper or Marine Series, by J. Starkie Gardner, F.G.S. The author comes to the conclusion that the whole group is contemporaneous with the Bracklesham beds, and is not of Lower Bagshot age. Similar shore conditions probably extended into the London basin, and the beds mapped by the Survey as Lower Bagshot are probably of the same age as those at Boscombe, in which case nothing more than the Bracklesham is to be met with in the London basin. The similarity of the leaves, &c., from Bovey Tracey to those obtained by the author leads him to infer that the former also are of eocene, and not of miocene age. The author increases the thickness of the London clay at Alum Bay at the expense of the Bagshot beds, and diminishes that of the Bracklesham beds at Whitecliff Bay by transferring part of them to the Lower Bagshot.—Notes on certain modes of occurrence of gold in Australia, by Richard Daintree, F.G.S.—Notes on the geology of the Island of Mauritius and the adjacent islets, by W. H. T. Power, B.A. (Communicated by W. Whitaker, F.G.S.)

Entomological Society, February 6.—H. W. Bates, F.L.S., F.Z.S., president, in the chair.—Prof. J. O. Westwood, Mr. J. W. Douglas, and Mr. F. Smith, were nominated by the president as vice-presidents for the year.—Mr. Rich. S. Standon and Mr. T. W. Wonfor, were elected Members of the Society.—Mr. J. Jenner Weir exhibited the following spiders:—three species identified by Sir Sydney Saunders as *Atypus sulzeri*, taken at Lewes; a remarkable form from Madagascar, and a small species beaten out of trees in the New Forest, which in marking and coloration, resembled lichen.—Mr. McLachlan exhibited a small collection of dragon-flies in illustration of a paper he communicated entitled "Calopterygina collected by Mr. Buckley in Ecuador." The collection contained a fine series of a new species, *Euthore mirabilis*.—Mr. Meldola exhibited a remarkable specimen of *Leucania conigera*. The colour and markings of the fore-wings were reproduced in the lower half of the left hind-wing.—Mr. Meldola read extracts from a letter addressed to Mr. Chas. Darwin from Dr. Fritz Müller, St. Catharina, Brazil, containing some valuable observations on the discrimination exhibited by a number of butterflies for certain colours in flowers. Mr. Müller also described the odoriferous organ of a male sphinx-

moth which exhaled a strong musk-like odour, and called attention to a secondary sexual character observable in some species of Callidryas and other Pierinæ, in the serration of the costal margin of the anterior wing. This is confined to the males, though sometimes found in the females of Callidryas Philea, but in a far less degree.—Reference was made to a sphinx-moth, the proboscis of which, measuring 22 centimetres, had been forwarded by Mr. Müller and was exhibited at the meeting.—Mr. A. G. Butler stated that he had measured the probosces of all the Sphingidæ from Madagascar contained in the British Museum, and found that none of them exceeded 5 inches in length. He also stated that the Callidryades in the British Museum with serrated costal margins to the fore-wings, included the males of all the species of the genera Catopsilia, Phœbis, and Callydryas (true), with the addition of one or two other species. The President observed that in the genus Prioneris the serrated costal margin existed in both sexes.—The Secretary, on behalf of Capt. Elwes, exhibited some coloured illustrations of butterflies which had been taken by a new process of nature-printing.—Mr. G. C. Champion exhibited a specimen of the rare British beetle *Anthicus bimaculatus*, taken at New Brighton, and some specimens of the genus Cetonia, from the Mediterranean region.—Mr. J. W. May exhibited a specimen of *Carabus intricatus*, which he described as taken, for the first time, in the neighbourhood of London.—Mr. H. Goss called attention to the occurrence of sexual dimorphism in *Erebia medea*, exhibiting specimens of both forms of the female.—Sir John Lubbock read a paper on the colouring of British caterpillars. Accepting the principle laid down by Mr. Darwin and others, that dull-coloured, green, and smooth-skinned caterpillars are eaten by birds, &c., whilst spiny, hairy, and brightly-coloured species are rejected, the author stated that by the statistical method it was shown that no hairy caterpillars are green, whilst, on the other hand, a large majority of black and brightly-coloured species are hairy or otherwise protected.—Mr. Meidola read extracts from a recent communication by Dr. Fritz Müller in *Kosmos* on the subject.—The following papers were communicated by Mr. C. O. Waterhouse:—"Description of a new Dragon-fly (Gynacantha) from Borneo," "Description of a new Species of Chernetidæ (Pseudoscorpionidæ) from Spain," "On the Different Forms occurring in the Coleopterous Family *Lycidæ*, with Descriptions of New Genera and Species."

PARIS

Academy of Sciences, March 4.—M. Fizeau in the chair.—The following papers were read:—On the theory of the telephone, by M. Du Moncel. The theory of speech being transmitted by electro-magnetic action causing the plate of the receiving telephone to repeat the vibrations of the sending one, is, he thinks, untenable. The plate in the receiving instrument merely strengthens by reaction the magnetic vibrations of the bar, which seem to be due to contractions and dilatations of the magnetic molecules, through being successively magnetised and demagnetised. Induced currents probably owe their advantage for this work to their *instantaneity*. Their greater or less intensity is of small account.—The vibrations of matter and the waves of the ether in photo-chemical combinations, by M. Favé.—Report of Committee on the importance of preservation of certain erratic blocks situated on French territory, and on the work of MM. Falsan and Chautre, on ancient glaciers and the erratic region of the middle part of the Rhône valley, by M. Daubrée.—On the telluric etiology of cholera, by M. Decaisne. Cholera appears on all geological formations, but its development and propagation depend largely on the physical aggregation of the ground, its permeability for water and air, and the variable quantity of water it contains. The partisans of the telluric doctrine always suppose a specific infectious substance or cholera germ, which is propagated from place to place by human communications, not by the atmosphere.—Study of the resistance of the air in the torsion-balance, by MM. Cornu and Baille. Eliminating accidental perturbations, they have established these two laws: (1) The amplitudes or distances of two successive elongations decrease in geometrical progression; (2) The epochs of the elongations are in arithmetical progression. One theoretical consequence is that the resistance of the surrounding air to the movement of the lever is proportional to the first power of the angular velocity of the lever.—Influence of electricity on evaporation, by M. Mascart. Small basins containing water or moistened earth were placed under conductors (having the form of circular gratings), which were electrified by a Holtz machine driven by a water-motor, and were kept in a constant electric state. The evaporation was thus constantly increased, sometimes even doubled. Inequalities of temperature, however, veil the influence of electricity; the basins were inclosed in a large case, the air in which was regularly dried, and in winter the operation was performed in a kind of subsoil.—Observations on gallium, by MM. Lecoq de Boisbaudran and Jungfleisch. *Inter alia*, the authors exhibited anhydrous chloride, bromide, and iodide of the metal.—Discovery of a small planet at Clinton, New York, by Mr. Peters.—Theory of Vesta, by M. Perrotin.—On the employment of particular solutions of a differential equation of the first order and the first degree, in the investigation of the general integral, by M. Darboux.—On the fundamental points of the group of plane curves defined by a differential equation of the first algebraic order, by M. Fouret.—On the sumnatory formula of Maclaurin, by M. Callandreau.—On the elastic forces of vapours emitted by a mixture of two liquids, by M. Duclaux. A mode is indicated of calculating beforehand the boiling temperature of a liquid of known constitution.—Theory of the new direct-vision spectroscope, by M. Thollon.—On the combustion of gases, by M. Schürzenberger. This relates to the propagation of combustion in eudiometers. The chief conditions affecting the phenomenon are: pressure of the gas, length of the gaseous column, composition of the mixture, and diameter of the tube.—On two allotropic varieties of magnetic oxide of iron, by M. Moissan. Sesquioxide of iron heated in an atmosphere of hydrogen or carbonic oxide to 350° or 440°, is transformed in a few hours into magnetic oxide; but this is very different in properties from the magnetic oxide got at a high temperature, by decomposing water with iron at a red heat or burning iron in oxygen, or decomposing sesquioxide at a lively red.—On the action of fluoride of boron on anethol; study of fluorhydrate of fluoride of boron, by M. Landolph.—New carbonated cupric liquor for determination of glucose, by M. Pellet.—On lactic fermentation, by M. Boutroux. He describes the form of the organism present and its mode of action.—Researches on the chemical composition and the functions of the leaves of plants, by M. Corenwinder. The predominance of azotised substances in young leaves indicates that it is these substances which exercise the respiratory function (absorbing oxygen and exhaling carbonic acid). Phosphorus too is in much less quantity in the older leaves, which again are rich in calcareous salts, and the chlorophyll in them retains and decomposes the CO_2 emanating from respiration.—Researches on the maturation of olives, by M. Roussile.—On the mineral water of Challes, in Savoy, by M. Willm.—On the frequency of glaucoma on the north coast of Africa, by M. Gayal.

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